



## Energy Surety for Mission Readiness

By David Menicucci, Roch Ducey, and Paul Volkman

Increased energy security and decreased dependence on fossil fuels are two major objectives of the new Army Energy Strategy for Installations. Both goals suggest that the Army consider diversifying its current use of the local electric utility for primary power and engine-driven generators for emergency back-up power. They also call for including renewable energy systems such as wind, solar, geothermal, and biomass, and other advanced distributed generation (DG) technologies such as fuel cells and microturbines. Increased energy reliability and security and, therefore, enhanced mission readiness, can be achieved by networking these power systems together in an “intelligent” microgrid. This concept is built on the philosophy that, “the whole is greater than the sum of its parts.”

To assess the microgrid’s potential for Army use, the U.S. Army Engineer Research and Development Center (ERDC) is working with ACSIM, HQ-IMA, and the Research and Development Engineering Command (RDECOM). ERDC is investigating how the energy surety microgrid concept can be implemented, not only at the installation and remote training facility level, but at forward base camps, tactical operation centers, and Soldier power — in other words, “home station to foxhole.” ERDC’s Construction Engineering Research Laboratory (CERL) and its Army partners are joined in this effort by Department of Energy laboratories, Sandia National Labs in particular.

### ***What Is Energy “Surety?”***

Energy “surety” is a term that has been derived from defense applications and is being used here to characterize energy systems. It incorporates a variety of factors including security, reliability, safety, sustainability and cost effectiveness. An energy system is said to have high levels of “surety” if it delivers the energy product to the end user while meeting all of the surety elements.

Sandia and ERDC-CERL are currently focusing much of their efforts on energy reliability and security, with a secondary consideration on the other three elements. These two elements are of primary concern to military facility operators and security teams.

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The traditional approach to protecting buildings from grid interruptions is based on back-up generators and Uninterruptible Power Supplies. That approach addresses only a subset of the surety elements. For example: they typically cannot be run full time; they depend on a supply of fossil fuel, a diminishing and increasingly costly resource located in unstable regions of the world; and they are typically only about 80% reliable in coming on line when needed unless they are meticulously maintained. They are, however, generally proven technologies.

Within the framework of the energy surety model, a number of requisites have been identified for an energy system with high levels of surety:

- Reducing the number of single points of failure
- Generating the energy as close to the load as possible
- Running generators full time
- Using proven technologies
- Varying the generation mix with renewables and other advanced DG
- Securing the fuel supply
- Including sufficient and appropriate on-site fuel/energy storage

### ***The Energy Surety Microgrid***

A microgrid appears to meet these basic requirements. The microgrid concept refers to a subset of the grid, in which distributed generators supply power. The *surety* microgrid is designed to meet the essential factors noted above.

While the surety microgrid is interactive with the local utility grid and its generators share power delivery to the entire installation, it can isolate itself from the grid and provide power to mission critical facilities, on its own, should the grid fail for any reason. In effect, the on-site generators become the primary sources of power for the buildings within the surety zone and the grid becomes the back-up energy source. In addition, depending on its design, it can meet the requisites for an energy system with high levels of surety.

Some of the most important tasks involved in developing the surety microgrid include:

1. Develop surety requirements (i.e., determine what facilities to protect, the level of protection and the type of generators)
2. Optimize the amount of fuel/energy storage
3. Properly control the surety microgrid
4. Model and measure the microgrid's effectiveness
5. Insure proper interconnection to the grid

The military is interested in the surety microgrid concept because there is a growing awareness of the defense mission's dependence upon the energy infrastructure and the vulnerability of that infrastructure to natural and man-made disasters.

### ***The Sandia/ERDC-CERL Effort***

A technical team has been assembled to develop and apply the surety microgrid concept on a military base. Sandia is the lead lab and ERDC-CERL is a principal collaborator. The program is funded in FY06 and will address all of the technical challenges noted above. This is called the Phase 1 surety microgrid development activities.

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After completing Phase 1, additional funding is expected for Phase 2, which will focus on studying how the surety microgrid concept could be implemented on an actual military base. The funding will not be sufficient to build such a microgrid, but the study will help the team to understand whether the basic concepts hold promise in meeting the specific surety needs of an actual military base. Phase 2 is expected to begin in October, 2006 and be completed in spring 2007. Installation Energy Managers who might be interested in hosting the Phase 2 demonstration should contact Paul Volkman at HQ-IMA, 703-602-1540.

### ***A New Army/DoD Energy Surety Capability***

At the conclusion of this effort, the team will be able to: quickly review a military base, with emphasis on its mission and associated energy requirements; determine through modeling the consequences of an energy disruption on the base mission; assess whether a surety microgrid can improve the situation; and, if appropriate, develop an optimally designed surety microgrid. This capability could significantly augment existing Installation Energy Security Plans. The Sandia/ERDC-CERL team welcomes comments and suggestions from the Army DPW community.

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